

SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

XCIX.]

APRIL, 1874.

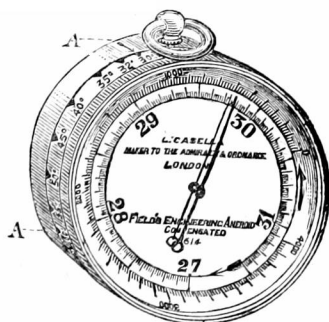
[PRICE FOURPENCE,
or 5s. per ann. post free.]

NEW INSTRUMENTS.

THE pressure upon our space for many months past has prevented our keeping *au courant* with the above subject. Moreover, there has lately been a remarkably rapid succession of new instruments, designed especially by three of our principal makers. The first three instruments which we are about to mention have been already described in these pages, having been exhibited at the Bradford Meeting of the British Association. We refer briefly to them here for the double purpose of rendering this article complete, and supplying engravings of two of them.

Field's Engineering Aneroid.

The fundamental principle of this instrument is very good. It is that of not merely compensating the aneroid for temperature—that, with greater or less success, has been done before—but enabling the observer to make the instrument give altitudes corrected for the temperature of the air. For the precise *modus operandi*, we must refer our readers to Mr. Field's paper (*Meteorological Magazine*, vol. viii. p. 139), but roughly it may be described as merely turning the glass cap of the aneroid until the engraved figure on the outside, which most

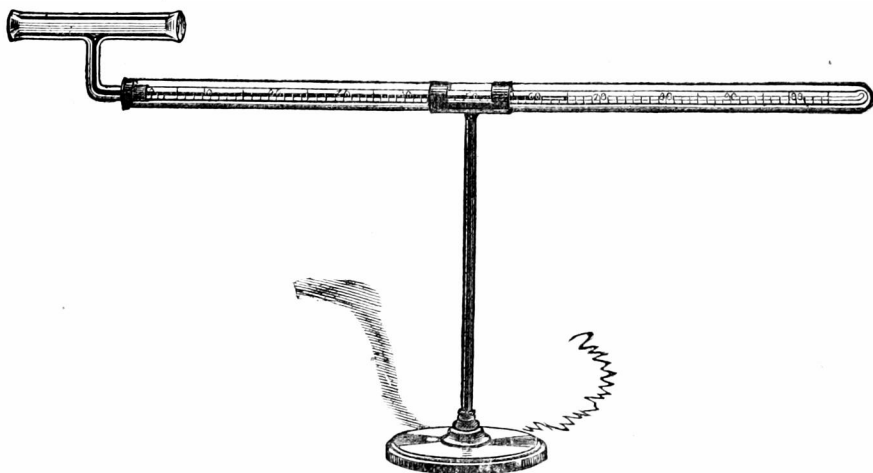


nearly agrees with the air temperature, is opposite the little black arrow at the top of the instrument. For reasons, upon which we cannot stop to enlarge, none but the very best selected aneroids can be

used for this arrangement. Therefore, in addition to the convenience of the scale, those who provide themselves with these instruments have a necessary guarantee that in addition they have an extremely good aneroid with the ordinary graduation. The size is that of the usual "watch aneroid," and the maker Mr. Casella.

Hicks's Double-cylinder Minimum Thermometer.

In a previous article we described the bifurcated bulb whereby Mr. Casella first gave great sensitiveness to alcohol thermometers. The present instrument affords another mode of doing the same thing, and is very successful, its sensitiveness being equal to that of a mercurial thermometer with a bulb one-third of an inch in diameter. The essential principle is, that instead of the alcohol being in a compact form, as in a spherical bulb, it is spread in a very thin layer between the double glass cylinders, by which means its sensitiveness is greatly increased.



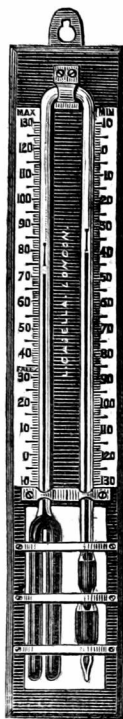
Negretti's Test-gauge Solar Radiation Thermometer.

The experiments of the late Mr. Nunes showed the necessity for great exhaustion in so-called vacuum thermometers, but there was no method by which the degree of exhaustion could be ascertained except by destroying the instrument. Messrs. Negretti and Zambra overcome this difficulty by a remarkably pretty application of a small mercurial test-gauge, which, being enclosed in the vacuum jacket before exhaustion, shows at any time the extent to which it has been carried.

Hicks's Electric Test for Vacuum Thermometers.

This is another and subsequent mode of effecting the same object as that just described. Mr. Hicks welds a platinum wire in each end of the vacuum jacket. It is then only necessary at any time to connect these with a small battery, in order to determine by the colour and stratification of the tube the amount and character of the residual air.

Casella's Mercurial Six's Thermometer.



This is essentially an *instrument de luxe*—it is undoubtedly that, for it is one of the prettiest instruments ever made. Moreover, it is certainly as much better, as it is prettier, than the old form of Six's thermometer, for its sensitiveness is exactly double that of one of the same size of the old construction. The new form differs from the old in nearly all respects, and yet preserves a general similarity. We must justify these contradictory statements by a brief description of the points of resemblance and difference. Both patterns contain both mercury and spirit; in both there are two vertical scales—one for max. and one for min.; in both the mercury is at the bottom of the columns; in both the indices are in columns filled with alcohol, and are pushed upwards by mercury; and in both patterns the scales for max. and min. read in opposite directions, the former upwards, the latter downwards. The differences are, however, very great, very essential, and, as far as we have tested, decided improvements. In the old pattern the indications primarily depended upon the expansion of alcohol contained in a single cylindrical bulb: in the new pattern the sensitive bifurcated bulb is used, and mercury is substituted for alcohol as the principal thermometric liquid.

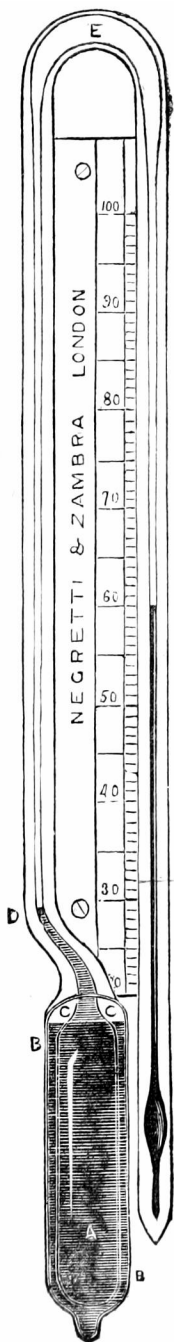
In fact, throughout the instrument the respective liquids are everywhere reversed, so that while in the old form there was only one short length of mercury, there is in the new only one short length of spirit. The maximum indication is the direct product of the thermometric liquid, while in the old one this was true of neither, and the max. column is on the opposite side. Difficulties of transport, and from the use of two liquids, will always limit the employment of this class of instrument, but for a window thermometer, and for the better class of conservatories, we know of none handsomer, more sensitive, or equally suitable.

Negretti's New Deep Sea Thermometer.

One of the "happiest thoughts" in the department of instrumental meteorology was that by Messrs. Negretti and Zambra of inserting a fibre of glass in the tube of a mercurial thermometer, so as virtually to make a trap-door, and thereby constructing the only underangeable maximum. In its ordinary form as a horizontal maximum, this instrument is so well known that we need not dwell upon it. A special modification of it was arranged by Messrs. Negretti for Prof. Everett and some of the observers of the Underground Temperature Committee of the British Association, in which the thermometer was used

bulb uppermost, and the reading obtained by noticing the length of the column found at the bottom end of the tube—viz., that furthest from the bulb. The essential principle of this arrangement was, therefore, the measurement by a scale not starting from the bulb, of the amount of mercury forced past the trap-door by the expansion of that in the bulb.

Messrs. Negretti have now carried this principle much further, and produced a mercurial thermometer, which, by the very simple process of reversal, will bring from any time or place the actual temperature (subject, we think, to an uncertainty of $0^{\circ}2$ or $0^{\circ}3$) at the instant and place of its reversal. The annexed cut will enable our readers easily to understand the arrangement:—
 A Bulb of thermometer; B Shield to protect from sea pressure; C Space for expansion of protecting liquid; D Glass fibre, or trap-door; E Enlargement to allow rapid passage; F Indicating tube.



Under ordinary circumstances all the mercury is in the bulb A, or between it and E, and the obstruction at D is so arranged as not to impede the passage of the mercury either upwards or downwards, and, therefore, it is evident that the length of column above D will at all times be a measure of the true temperature of the instrument. If the thermometer be turned bulb upwards, the column will break off at D and run into E, whence, on a second half turn, it will fall into the tube F, and remain there until the instrument is turned in the reverse direction by the observer. When we first considered this arrangement, we doubted whether the mercury would always break off cleanly at D, and at exactly the same point; but we have since tried several of the instruments, and find that they all act perfectly. There is, however, one cause which, as we have said, may lead to small errors of $0^{\circ}2$ or $0^{\circ}3$. It is the variation in the length of the indicating column due to alterations in its temperature; for suppose the instrument reversed at a temperature of 40° , and read in a temperature of 90° , it is evident that the indication on the scale will be higher than 40° by an amount equal to the expansion of the detached column by an increase of 50° in its temperature. The amount will be very slight, probably not more than we have stated. It could be entirely avoided, either by the very simple expedient of reading the thermometer in a temperature similar to that in which it was reversed, or by making the scale adjustable like a sympiesometer; but the amount is so small that we doubt if either is necessary.

It is evident that this instrument may be applied to a variety of

purposes—that it will supply data previously unattainable—and that it is a very valuable addition to the instruments of observation now available for meteorologists.

THE WINTER OF 1873 IN SWITZERLAND.

To the Editor of the Meteorological Magazine.

SIR,—As it may interest some of your readers to know my experiences of a winter in the Swiss mountains at an elevation of 3,000 odd feet, I annex a short weather table. My instruments are all by Casella, and (with the exception of the barometer) new, and verified recently at Kew. The barometer is one of Casella's best standard mercurial mountain barometers which I have had many years, and which was re-verified last year. The maximum and minimum thermometers (which are in a louvre stand) are "Phillips and Rutherfords'" grass ditto with divided bulb. Rain gauges two, one ordinary copper gauge with low rim to funnel; the other, which I have termed the snow gauge, has a rim six inches deep before funnel commences, and is similar to one Casella made for me years ago, and which you may remember seeing at my house in Wiltshire. I consider it the best form of rain gauge for this reason: in rain it and the one with the low rim to funnel work exactly together; in snow, especially with wind at the same time, the low-rimmed funnel is useless.

I have inserted six columns, showing the number of days on which the thermometer fell below 15, 10 and 5 degrees and those on which it did not rise above 15, 20 and 32 degrees. On one day, Dec. 13th, our maximum was 11°. This might alarm some people, but the cloudless skies and the extreme *stillness* of the air prevent the cold being felt. I regret not having a solar thermometer, for the heat of the sun is very great, as you will be able to judge from the maximum column. People are under the impression that at these elevations you are buried in snow and fogs, and I had more than one warning of the risk I ran in bringing my family here. All I can say is, we have never passed a pleasanter winter or felt the cold so little. Although we consist of nine, some of whom are young children, coughs and colds, or even a day's illness, have been entirely unknown.

It really is almost worth while to spend a winter in these regions if only for the purpose of seeing the beautiful forms ice and snow can take. Cascades and water ducts for supplying mills become masses of beautifully-shaded ice and icicles like Bohemian glass or Parian marble, while at ten degrees of Reaumur the whole surface of the snow on ground, trees, and plants, becomes covered with crystals which sparkle both in sun and moonlight in a wonderful way. The longer the intense cold continues the larger these grow. I cannot give you their shapes, but they are some of them to be found in Professor Tyndall's interesting work, "The Forms of Water," under the head of "Snow Crystals."

Each day from the beginning of December (when the cold weather was ushered in by a violent thunderstorm) till this moment, my children have skated on a rink I made by flooding the stable-yard, repeating the process each evening, so that a perfect piece of fresh ice presented itself every morning. Time therefore has not hung heavily. Rossinière is well known as a charming place in summer, with abundance of wild flowers, and I can well recommend Madame Reymond and her comfortable chalet to any one in search of health and fine air.

The mean amount of humidity at 9 a.m. for the last four months, as calculated from a small Alpine dry and wet bulb of Casella's, is 82, but as it is not verified I have not inserted the amount in the table, particularly as from the dryness of the air here I doubt the humidity being so great even at that early hour.—I am, dear Sir, truly yours,

MICHAEL FOSTER WARD, F.M.S.

Rossinière, Canton Vaud, March 6, 1874.

Monthly Means, &c. of Meteorological Observations taken at Rossinière, Canton Vaud, Switzerland.

Lat. 46°28' N., Long. 7°5' E. Height above Sea Level, 3,019 feet, English.

Readings taken 9 a.m. local time—31 min. in advance of Greenwich time.

1873.	Bar. reduced to 32° Fahr.	Thermometer.												
		Extremes.			Means.				Days on which Ther. fell to or below			Days on which Ther. did not go above		
		Max.	Min.	Grass	9 a.m.	Max.	Min.	Grass	15°	10°	5°	15°	20°	32°
	in.													
October	26·896	67	22	18	40·9	47·7	36·3	33·5	...	...	...	...	...	...
November ...	26·895	51	13	5	33·3	41·9	28·8	24·4	4	...	...	...	...	4
December.....	27·190	42	1	—6	19·4	25·6	15·5	9·6	18	11	5	5	11	23
1874.														
January	27·168	51	5	0	24·2	35·0	18·0	15·0	14	4	1	...	3	8
February	27·014	52	—2	—10	25·0	29·5	17·6	14·0	12	3	2	...	...	2

1873.	Amount of Cloud. 0—10	Absolutely Cloudless days.	Prevailing Wind.										Rain Gauge	Snow Gauge	Days on which R or S fell.
			Calm.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	1ft. 6in. above ground.			
October	3·8	19	1	...	15	...	...	...	1	14	...	1·415	2·085	7	
November ...	4·8	15	6	...	...	...	...	...	4	12	8	4·250	4·650	6	
December ...	1·0	25	23	...	5	...	...	...	1	1	1	0·830	1·106	3	
1874.															
January	2·0	22	14	...	16	...	...	...	...	1	...	0·750	1·110	5	
February ...	1·7	19	22	2	2	...	...	...	2	...	...	0·200	0·500	2	

HALOS, CORONÆ, BAROMETER, AND ZODIACAL; LIGHT.

To the Editor of the Meteorological Magazine.

SIR,—I beg to subjoin a list of the halos and coronæ observed here during the month of March. I do not remember ever seeing so many in one month. The solar halos, too, were remarkably well seen, the spectrum being very distinct. The lunar and solar halos were all of about 22° radius. The lunar coronæ were magnificent on the 29th and 30th. The order of the coloured rings, beginning with that nearest the moon, was as follows :—white, yellow, orange, brown, blue, green, yellow, orange. The diameter of the outermost was about 10°. During the furious gale which raged here on the 2nd of April the barometric column was much disturbed; from 9 a.m. until 2 p.m. its oscillations were readily seen. At noon they were greatest, and the space traversed by the top of the column in the up and down movement frequently amounted to $\frac{1}{16}$ th of an inch.

Solar halos on the 21st and 25th; Lunar halos, on the 24th, 26th, 28th, 30th, and 31st; Lunar coronæ, on the 29th and 30th.

The zodiacal light was finely seen on the 10th, 11th, 18th, and 19th.

I am, Sir, yours truly,

JOSEPH GLEDHILL, F.G.S., &c.

P.S.—No solar halos were seen in January, and but one in February 11th); one lunar halo was seen in January, on the 2nd, and one in February, on the 28th. Three lunar coronæ were observed in January, and but one in February.

The Observatory, Skircoat, Halifax, April 2nd, 1874.

WINTER MEAN TEMPERATURE FORESHOWN BY BRITISH RAINFALL.

To the Editor of the Meteorological Magazine.

SIR,—The law and table to which I referred in my last letter are as follows :—“When the mean rainfall of the Spring period (April and May) at nearly fifty stations is below 4½ inches, the following winter is colder than the average, unless the rainfall of the Summer period (July and August) is above 6½ inches. And if the Spring rainfall is above 4½ inches, the Winter will be warmer than the mean, unless the rainfall of July and August is below 3½ inches.”

The following way of putting it, however, is still more simple :—“When the mean monthly rainfalls of April, May, July, and August, at nearly fifty stations, are together above 10·30 inches, the Greenwich mean temperature of the following December to March (inclusive) will be above the average also; and when below 10·30 inches, will also be below the average in Winter mean temperature.” Any of your readers who have all the volumes of your “Magazine” and “British Rainfall,” can check my figures as far back as 1862. The mean falls I have given for 1860 can be checked by casting up the monthly totals on page 314 of “Beardmore’s Manual of Hydrology,”

and dividing by the number of stations, which, in that case, amounts to sixty-one. In the Magazine for September, 1868, there are more total falls omitted in the (August) table, than will be found for any other month in question. I have therefore added two important returns to that table, viz., 13·70 inches for Borrowdale (Seathwaite), and 10·17 inches for Portree. These amounts should be added, by those of your readers who may feel disposed to check my figures. Mr. Vernon can do with this "theory" what he says he desires (at least as far back as 1862 and 1860); he can "compute the meteorological elements," and then "compare them with the actual observations (at Greenwich), as in the case of astronomical observations," and prove to himself that "prediction" is not "mere moonshine." All he has to do is to cast up the total falls of April, May, July, and August, as given in your Magazine, &c., divide by the number of totals, whatever it may be, for the particular month, add the four results together, and "compare" the gross total thus obtained with the Greenwich mean temperature of the following December to March. I shall feel pleased if he will in this (his own way) test the accuracy of my theory.

The following is the table:—

YEAR.	Mean of the total Rainfalls (at nearly 50 stations) of			Difference of the mean of the total Rainfalls of April, May, July and August, from 10·30 inches,	Difference of Greenwich mean temp. of Dec. to March inclusive from the average (39°30') of 50 years.	Years of Winter.
	April and May.	July and August.	April, May, July and August.			
	in.	in.	in.	in.	°	
1873	3·50	8·44	11·94	+ 1·64	+ 1·87	1873—74
1872	5·15	7·46	12·61	+ 2·31	+ 1·00	1872—73
1871	4·72	7·06	11·78	+ 1·48	+ 2·95	1871—72
1870	3·64	3·38	7·02	— 3·28	— 0·78	1870—71
1869	5·70	3·05	8·75	— 1·55	— 1·30	1869—70
1868	4·71	5·95	10·66	+ 0·36	+ 3·17	1868—69
1867	7·33	7·31	14·64	+ 4·34	+ 1·12	1867—68
1866	3·69	6·82	10·51	+ 0·21	+ 0·57	1866—67
1865	4·87	8·04	12·91	+ 2·61	+ 2·27	1865—66
1864	3·84	3·60	7·44	— 2·86	— 2·30	1864—65
1863	3·82	4·87	8·69	— 1·61	— 0·05	1863—64
1862	7·55	7·55	15·10	+ 4·80	+ 3·55	1862—63
1861	2·40	9·18	11·58	+ 1·28	+ 1·75	1861—62
1860	4·19	6·02	10·21	— 0·09	— 0·30	1860—61
1859	4·26	5·57	9·83	— 0·47	— 0·98	1859—60
1858	5·66	6·01	11·67	+ 1·37	+ 3·42	1858—59
1857	5·16	5·17	10·33	+ 0·03	+ 0·35	1857—58
1856	5·87	6·05	11·92	+ 1·62	+ 0·15	1856—57
1855	3·24	6·44	9·68	— 0·62	— 0·38	1855—56
1854	3·64	4·92	8·56	— 1·74	— 3·43	1854—55
1853	3·45	6·30	9·75	— 0·55	— 0·23	1853—54
1852	3·31	7·06	10·37	+ 0·07	+ 1·15	1852—53
1851	3·42	7·64	11·06	+ 0·76	+ 1·82	1851—52
1850	5·57	6·60	12·17	+ 1·87	+ 2·25	1850—51
1849	5·56	6·60	12·16	+ 1·86	+ 0·10	1849—50
1848	3·92	8·67	12·59	+ 2·29	+ 3·15	1848—49

In conclusion I will make a few remarks suggested by the above table :—

(1.) When the total (mean) fall of April, May, July, and August has been below 8·60 inches, we have always had a very severe winter, as in 1870-71, 1864-5, and 1854-5.

(2.) When the total (mean) fall of the aforesaid months is less than 10·60 inches, but above 8·60 inches, the following winter is partly very severe. Such was the case in 1869-70, 1866-67, 1863-4, 1860-61, 1857-8, 1855-6, 1853-4, and 1852-3.

(3.) The mildest Winter (1862-3) occurred after the greatest Spring and Summer rainfall (15·10 inches). See Table.

(4.) In consequence of other influences, such as uniform monthly mean temperatures, a hot May (for in the last fifty years we have always had a mild winter after a very warm May, such as those of 1868, 1865, 1862, 1848, 1847, 1841, 1834, and 1833), a warm Autumn, &c.—I say in consequence of these other influences, the degree of Winter mean temperature is not always in proportion to the amount of the previous Spring and Summer rainfall; but I think the correspondence is sufficiently near, as a whole, to justify what I said in my last letter, “that the Table is the best (of the kind) I ever gave, or have ever seen.”

GEORGE D. BRUMHAM.

Barnsbury, April 4th, 1874.

SEVERE COLD IN MARCH.

To the Editor of the Meteorological Magazine.

SIR,—I send you the thermometer readings that occurred here during the remarkably cold period which occurred between the 8th and 13th of March.

Date.		Min.		Max.		Snow in Inches.
9th	...	33°	...	38°·5	...	2
10th	...	22°	...	35°	...	2
11th	..	19°	...	33°·5	...	1
12th	...	16°·5	...	42°	...	0

So intense was the cold on the 10th and 11th that the snow remained unmelted throughout the day—a very rare occurrence in March. Blinding snow-drift on the 11th up to 10 a.m., and the minimum of the following night (16°·5) lower than I have ever recorded for March. On the 23rd the thermometer reached 65°·5—a range of 49 degrees in 11 days.

Faithfully yours,

WM. CARTER.

Bucknall, Lincolnshire, April 1st, 1874.

P.S.—The paucity of easterly wind during the last four months is noteworthy. Between the first of December and the 1st of April the wind has blown from E. and N.E. on three days only.

To the Editor of the Meteorological Magazine.

SIR,—A fall of light, dry snow, to the depth of 3 or 4 inches, on the 10th was followed by severe cold. Two mercurial minimum thermometers in screen at 4 ft. registered $7^{\circ}\cdot 5$, and one of Casella's forked minimum thermometers on the snow— 5° . On Pen-hill (1800 ft.) the minimum was $12^{\circ}\cdot 5$, and the maximum in March $50^{\circ}\cdot 5$. Here the maximum was $56^{\circ}\cdot 2$ on the 24th.

I am, Sir, &c.,

F. W. STOW.

Aysgarth, Bedale.

THE LAW OF STORMS.

To the Editor of the Meteorological Magazine.

SIR,—At the majority of stations, both in Europe and in North America, an increase of wind-force, accompanied by a brisk diminution of pressure, is of by no means uncommon occurrence with a wind from due west. The phenomenon is ordinarily the result either of the rapid expansion of a depression in the north, or of its progress in a direction considerably to the south of east. Not only those who, like your correspondent, regard the distinction between "circular" and "incurving" cyclones as imaginary, but others also may well ask, On what grounds would Mr. Birt refuse to attribute a similar phenomenon, when occurring on the surface of the North Atlantic, to a similar cause?

Homeward-bound vessels in the North Atlantic not unfrequently experience a decreasing pressure with an increasing westerly wind, especially, as would appear, between the parallels of 25° and 40° west. What reasons are there for the supposition that in such instances a cyclone of abnormal character is being encountered?

There is a further query I should like to make. In the present state of cyclonology, will not a new code of rules, such as it is proposed to frame, be likely to be regarded by most practical sailors as superfluous and perplexing? They are aware that a cyclone (although its probable course can be readily conjectured) does not travel like a locomotive along an absolutely fixed line. A captain possessed of ordinary intelligence, on experiencing an increase of storm, with a rapid fall of the mercury, does in any case conclude that he is likely to be getting nearer to the centre of depression, and is able to shape his course accordingly, without having to decide the hypothetical species or sub-species of cyclone which he has encountered.

And, supposing the new rules likely to be generally accepted by naval men, will not *too much haste* in framing them be quite as likely as delay to "mean destruction?"—Yours truly,

W. CLEMENT LEY.

Ashby Parva Rectory, Lutterworth.

To the Editor of the Meteorological Magazine.

SIR,—As an outsider, I beg to thank Mr. Birt and Mr. Clement Ley for their letters in the Magazine. The idea of a perfectly circular wind was new to me, and I had no notion that it was generally

accepted or had ever been proved exactly correct. May I ask in what cases? The first diagram strikes me as unique, because I cannot at this moment think of any other instance in nature of a body moving in a circle if free to move in any other path. I can understand a vortex, because then the barometrical depression in the centre is connected with it either as cause or effect,—either the rotation is caused by the rush of air from all sides towards the centre, just as the removal of a plug from the bottom of a basin produces a whirlpool, or the depression is caused by the upward motion of the air in the centre of a whirlwind generated by opposing currents, as in the case of the little dust-eddies which one often sees. But if Buys Ballot's law is to be held to mean that the wind blows exactly along the isobars, and that a cyclone is a body of air revolving and progressing, like a humming top on an inclined plane, I cannot understand how it can take as high a scientific rank as the "cycles" of ancient astronomers. Those *were* modified by "epicycles" into an accurate expression of the facts, but here it seems we have been content with a law that is not only unscientific, but inaccurate. I am glad that Mr. Clement Ley has observed the "incurving" of ordinary winds. I should have guessed it at 15° on an average, from cursory inspection of the daily weather charts, but have not paid the attention to the subject which would warrant my expressing an opinion. It is certainly different with different winds.

If somebody who has studied the subject would give us a real induction, showing cause and effect, instead of a mere hand to mouth generalisation, we should have something worth calling a law.

I am, Sir, your obedient servant,

F. W. STOW.

THE METEOROLOGICAL SOCIETY.

The ordinary meeting of this society was held on the 18th ult. at the Institution of Civil Engineers, Dr. R. J. Mann, president, in the chair. The first paper was read by Mr. R. H. Scott, F.R.S., on "An attempt to establish a relation between the Velocity of the Wind and its Force (Beaufort Scale), with some Remarks on Anemometrical Observations in general." The author stated that he considered the existing scales of wind force were unsatisfactory. The highest pressure corresponding to Force 6 of the Land Scale was 36lb. per square foot, whereas pressures of above 40lb. had frequently been registered. He further brought forward proofs of the irregularity in the distribution of such high pressures. He then spoke of the Beaufort Scale, and pointed out some of its defects, but stated that, speaking generally, it might be considered to be a rough classification of the wind force, exact enough for practical purposes, and proceeding by nearly equal degrees. He had recently had comparisons made at Holyhead and at Yarmouth to test the velocity recorded by the anemometer at each station at the hours when the several figures of the Beaufort Scale were reported. The result was a scale which agreed very closely with that given by Schott, as a deduc-

tion from theory, in his discussion of the observations made by Sir F. Leopold M'Clintock in the *Fox*, and published by the Smithsonian Institution. Inasmuch as the accordance of practice with theory was very great, he proposed this scale for general adoption :—

Force.			Miles per Hour.		Force.			Miles per Hour.
0	...	...	2·5		7	...	...	40·5
1	...	...	8		8	...	...	48·5
2	...	...	13		9	...	...	56·5
3	...	...	18		10	...	...	65
4	...	...	23		11	...	...	75
5	...	...	28		12	...	...	90
6	...	...	33·5					

The paper then went on to point out, from experience gained at Holyhead, Yarmouth, and Falmouth, the very serious discrepancies which had been proved to exist in the records of velocity for the various points of the compass, especially at Yarmouth, and which showed that the influence of local situation, not only as to the contour of the country, but even the very shape and height of the observatory and adjacent buildings, exercised a most serious influence on the correctness of the data afforded by the instruments. It therefore seemed very dangerous to reason as to the mean motion of the air over the British Isles from the anemometrical records of one or two stations, as has been done by Dove. The next paper was by Mr. G. J. Symons, "On the Sensitiveness of Thermometers," in which he gave the results of a series of comparisons of the speed with which thermometers with bulbs of various sizes took up the true temperature to which they were exposed. Three series of thermometers were used :—A set with spherical bulbs filled with mercury, and varying in diameter from a quarter to three-quarters of an inch ; the result was that the small bulb took up the true temperature in about three minutes, while the large bulb took three times as long. A second set were similar in form, but filled with spirit ; they were more sluggish, but the small spirit ones were more prompt than large mercurial ones. Lastly, the new patterns of spirit *minimum* thermometers introduced by Mr. Casella and Mr. Hicks were tested, and found as sensitive as ordinary mercurial thermometers. The instruments were all examined by the Fellows at the close of the meeting. The last paper read was by Mr. Strachan, "On the Weather of 13 Autumns."

MARCH, 1874.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which '01 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Max.		Min.		In shade	On grass		
				Dpth	Date.			Deg.	Date.			Deg.	Date.
I.	Camden Town	·39	— 1·69	·08	12	12	65·4	23†	21·9	11	7	12	
II.	Maidstone (Linton Park).....	·83	— 1·66	·26	9	10	67·0	23	18·0	11	11	...	
III.	Selborne (The Wakes).....	·77	— 1·83	·14	31	9	59·0	23†	21·5	11	10	11	
IV.	Hitchen	·72	— 1·45	·35	9	14	60·0	27	18·0	10	15	...	
V.	Banbury	·85	— 1·35	·16	29	13	61·2	23	21·5	11	11	...	
VI.	Bury St. Edmunds (Culford).....	1·07	— 1·13	·26	9	10	65·0	23†	13·0	10	13	17	
VII.	Bridport	·54	— 2·33	·20	27	8	61·0	24	19·0	11	7	...	
VIII.	Barnstaple	2·07	— 1·08	·38	8	14	60·0	27	31·5	7	...	...	
IX.	Bodmin	2·08	— 1·67	·40	9	16	58·0	29	31·0	7	1	6	
X.	Cirencester	1·08	— 1·52	·24	29	13	...	...	...	...	...	...	
XI.	Shiffnal (Haughton Hall)	·88	— 1·06	·17	9	15	65·0	31	18·0	11	7	10	
XII.	Tenbury (Orleton)	1·04	— 1·38	·23	8	13	67·5	23	21·8	11	9	11	
XIII.	Leicester (Wigston)	1·00	— 1·11	·20	11*	12	67·0	23	17·0	10	9	...	
XIV.	Boston	·70	— 1·09	·20	9	9	66·0	27	20·0	11	7	...	
XV.	Grimsby (Killingholme)	1·07	...	·16	29	14	60·0	23	19·0	12	8	...	
XVI.	Derby	1·22	— 1·02	·20	17	13	67·0	23	21·0	11	5	...	
XVII.	Manchester	3·37	+ ·68	·71	17†	18	62·0	23	11·0	11	5	12	
XVIII.	York	1·36	— ·36	·25	29	14	62·0	22	21·0	11	8	...	
XIX.	Skipton (Arncliffe)	6·61	+ 1·80	1·89	29	19	...	...	...	...	...	...	
XX.	North Shields	1·04	— 1·31	·13	9	18	58·5	23	20·6	11	5	7	
XXI.	Borrowdale (Seathwaite).....	14·24	+ ·84	3·44	28	20	...	...	...	...	...	...	
XXII.	Cardiff (Ely).....	2·49	— ·46	·49	17	14	...	...	...	...	...	...	
XXIII.	Haverfordwest	3·48	+ ·03	·50	17†	17	55·5	22	20·0	11	6	12	
XXIV.	Rhayader (Cefnfaes).....	2·89	— ·95	·68	16	11	62·0	...	19·0	...	...	...	
XXV.	Llandudno	2·12	— ·14	·45	8	17	59·4	25	27·5	11	3	...	
XXVI.	Dumfries	2·01	— ·97	·33	28	19	58·0	29	23·0	10†	6	11	
XXVII.	Hawick (Silverbut Hall).....	1·88	...	·35	29	15	...	...	...	...	...	...	
XXVIII.	Kilmarnock (Annanhill).....	3·32	...	·79	15	21	57·5	26	22·0	11	5	7	
XXIX.	Castle Toward	4·37	— ·22	·58	16	22	53·0	7§	...	...	6	...	
XXX.	Leven (Nookton)	2·10	+ ·03	·52	29	15	59·0	24	23·0	11	8	18	
XXXI.	Stirling (Deanston)	...	...	...	...	...	...	...	...	...	...	...	
XXXII.	Logierait	2·63	...	·55	31	14	60·0	17**	16·0	9	6	...	
XXXIII.	Braemar	2·32	+ ·11	·55	29	15	55·1	22	20·6	10	8	21	
XXXIV.	Aberdeen	1·86	...	·22	1	23	63·5	23	24·6	10	6	15	
XXXV.	Portree	12·13	+ 3·09	1·87	16	27	...	...	...	...	...	...	
XXXVI.	Loch Broom	6·88	...	·84	27	27	...	...	...	...	...	...	
XXXVII.	Inverness (Culloden)	1·71	— ·25	·50	30	8	61·0	25	25·0	11	6	17	
XXXVIII.	Helmsdale	3·42	...	·62	11	22	...	...	...	...	...	...	
XXXIX.	Sandwick	3·46	+ ·13	·46	19	23	55·5	4	24·8	10	4	5	
XL.	Caherciveen Darrynane Abbey	3·20	...	·63	16	23	...	...	...	...	...	...	
XLI.	Cork	1·05	...	·30	27	13	...	...	...	...	...	...	
XLII.	Waterford	2·31	— ·58	·98	26	17	59·0	5	25·0	11	4	...	
XLIII.	Killaloe	3·25	— 1·07	·75	28	18	62·0	23	26·0	11	6	10	
XLIV.	Portarlinton	1·36	— 1·95	·47	29	22	58·0	22	22·5	10	6	...	
XLV.	Monkstown, Dublin	·78	— 1·80	·38	28	11	68·0	24	23·0	11	5	...	
XLVI.	Galway	4·34	...	1·28	28	21	61·0	25	24·0	10	4	...	
XLVII.	Ballyshannon	3·43	...	·47	31	26	50·0	27	29·0	9	1	...	
XLVIII.	Waringstown	1·63	...	·27	9	14	62·0	9	18·0	11	5	9	
XLIX.	Edenfell (Omagh).....	2·81	...	·48	28	19	56·0	23†	16·0	10	7	...	

* And 17. † 19. ‡ 27. § 17, 22, 23. || 22, 23, 24. ¶ 11. ** 23.
 +Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON MARCH.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail; S or Snow.

E N G L A N D.

CAMDEN TOWN.—The difference from the average of the first three months of the year is greater than the fall. January having been '78, February '31, and March 1'69 below the mean.

LINTON.—The second week very wintry, with more S than at any other time during the season; but the rest of the month fine and dry, the last week especially so. Fogs frequent; winds often brisk, but not remarkably high. Frost very severe on the 11th, while the 23rd was an unusually warm summer-like day; taken as a whole it has been a fine month, but as only 5'60 in. of R. has fallen during the last five months, (instead of 11'08 which is the average for that period), fears are entertained as to the water supply in the coming summer.

SELBORNE.—On the whole a damp, foggy, cheerless month, but with little R. No high winds until the close.

CULFORD.—Heavy fog on 1st and 2nd, and S fell more or less on the 9th, and the three following days. High wind on 28th, 29th, and 30th. On the 10th the temp. fell to 13°, or 19° below the freezing point, doing much damage to the fruit; while on the 23rd and 27th, the temp. (in the shade) rose to 65°; the average temp. of the month was 42'2. Easterly wind on nine days, and westerly during twenty-two.

BODMIN.—The only signs of winter during the whole season, were on the 9th, 10th, and 11th, when much S fell.

SHIFNAL.—March has come true to its character, for although the first six days were mild and pleasant, it changed to frost on the 7th, with thick fog on the 8th, and S from the N. W. the three days following; the night of the 10th was the coldest this winter, (ther. at 18°), and did much damage to the apricots then beginning to blossom. The Equinoctial gales came true to their time, from S. W., lasting from 18th to 22nd, and after an interval returned with increased violence on the 28th, continuing to the close. Average day temp. 50'2, that of night 37'5. Bar. unusually high (30'37) on the 6th. Large humble bee seen on the 6th; ringdove first heard, and rooks began to build on 7th. Fine Lent seed time.

ORLETON.—Warm and dry, but generally cloudy, to the 6th, when the bar. rose to 30'54, which is higher than it has been registered for many years. Frost then set in, with a fall of S on the 8th, and the weather continued cold till the 13th, with S showers on the 9th, 10th, and 11th, covering the ground, the remainder of the month was generally very warm and dry. On the 23rd the ther. rose to 67'5. A steady rough wind prevailed after the 26th. Mean temp. about 3'4° above the average of the month.

WIGSTON.—A dry month as regards rainfall, but a moist atmosphere for March; but little March dust. The 9th, 10th, and 11th, stormy, with a heavy fall of S on the 10th, which rapidly melted. Vegetation backward compared with many seasons.

BOSTON.—After passing through all the winter months with scarcely a vestige of snow, in the middle of this month after a period of fine dry weather, the ther. suddenly fell to 12° below the freezing point, and the ground was covered with S. On Sunday the 8th, the mean temp. was 41°, and the weather fine and sunshiny. On Wednesday the temp. was only 26°; the weather bitterly cold, with snowstorms and driving winds. On Saturday the temp. had risen to 44°, and the weather was fine and mild. On the 18th and 20th, very high tides, the water rising, on the latter day, to 16 ft. 4 in. above Ordnance datum, or 3 ft. 4 in. above an ordinary high spring tide; the water flowed up to the church door, and within 3 ft. of the top of the Sea banks; the highest known tide was in 1810, when the tide rose 18 in. higher; in 1854 it was 10 in. higher, and in 1868 8 in. higher than this of 1874.

GRIMBSY.—10th, ground covered with S; frogs spawning on the 18th; larch leaves opening on the 25th; hedges tinged with green on the 29th. Gale began at noon on the 28th, lasting, with short intervals, till the close of the month. 23rd, quite a summer's day. The dry state of the soil was favorable for sowing, but the stores of water are very low. Vegetation forward.

DERBY.—The constant high reading of the bar. and ther., the paucity of E, and the almost total absence of E. winds, have made March a very remarkable and enjoyable month. Vegetation is not in a forward state, owing, no doubt, to the absence of those warm showers so conducive to the propagation of vegetable life. Temp. $4^{\circ}4$ above the average.

NORTH SHIELDS.—7th, auroral arch from N.W. to N.E., near the horizon. S on the 9th, 10th, 11th, and 12th. Lunar halo on 24th.

SEATHWAITE.—T and L on 30th. $3\cdot44$ in. of R fell on the 28th, and more than 14 in. during the month.

WALES.

HAVERFORDWEST.—Very severe weather from 6th to 11th. S 5 in. deep on the level on the 11th; the S when melted produced $\cdot85$ in. Remarkably high bar. during the first six days; a very stormy wet period from the 26th to the end. Except the six severe days, the weather of this month was milder than usual. Measles of a mild type extremely prevalent.

CERNFAES.—Vegetation forward; prevailing winds S.E. and N.W.

LLANDUDNO.—A wave of sea fog passed over the town about noon, and again at 5.30 p.m. on the 2nd; aurora on the night of the 6th. S and H with T S on the 8th; last six days very stormy.

SCOTLAND.

DUMFRIES.—During the first half of the month very little rain fell; on several nights there was frost which was beneficial in checking vegetation, which was too advanced for the season. In the latter part of the month more rain fell, with frequent storms. On the whole, the weather mild; the mean temp. $3^{\circ}2$ above that of last year. The close of the month stormy and wet; on the 1st of April the Nithesdale and Annandale Hills were covered with S.

SILVERBUT HALL, HAWICK.—Frost on 6th, 10th, 11th, 12th, and 13th, and again on 23rd, 24th and 25th. Beautiful aurora on the night of the 8th. High winds on 11th, 17th and 19th, and from the 27th to the end of the month. Hills white with S on the 10th, 11th, 12th and 31st.

ANNAN HILL, KILMARNOCK.—Bar. pressure much higher than during last month. Prevailing winds S. Westerly, moderate to strong. The close of the month rough and stormy. The evenings were generally fine up to the middle of the month. Slight T heard on the evening of the 15th; snow and hail showers on the 9th, 18th, and 30th. Foliage bursting into leaf, and garden blossoms good; young grass and pastures also looking well. Ozone well developed; mean temp. $44^{\circ}5$. Small-pox nearly gone.

CASTLE TOWARD.—A very wet month throughout, with but few bright days from 9th to 12th; very hard frosts; min. on 11th, $20^{\circ}0$. Winds very variable, in the fore part of the month very piercing, preventing any growth being made. Little progress has been made in farming operations, and but a few oats are sown and potatoes planted. Fruit trees, such as plums, pears and apples, look well and blossom plentifully. On the morning of the 30th, a storm of T L and R.

NOOKTON.—Snowstorm from 1 to 4 p.m. on 9th. Stormy from 27th to the end of the month.

BRAEMAR.—A very fine month, and most favourable for farming operations.

ABERDEEN.—A month of mild but stormy weather; severe snowstorm with high winds in the second week. Bar. pressure and mean temp. above the average.

PORTREE.—A cold, wet, stormy month. Snow fell on the 8th and 9th to the depth of 13 in.; no such heavy fall has occurred here since 1868. Frequent gales in the latter part of the month. T and L from 10 to 11 p.m. on 17th, at 6 p.m. on 29th, and on the 31st nearly all day, with heavy H showers. The wettest

March since 1868 ; agricultural operations never so far behind at the close of this month as they were this season ; no seeds have been sown, the land is soaked with wet. Provender for cattle is getting scarce ; garden shrubs injured by the cold winds ; and fears are entertained, unless the weather improves, for the lambing time, which is near at hand.

CULLODEN.—Aurora bright to N. up towards zenith on the 8th, and a faint aurora over N. horizon on 9th. Snow on 10th, 11th, and 12th. Gale on 20th. Solar halo on the same day. Gales on 28th and 31st.

SANDWICK.—March has been warmer and wetter than the mean ; from the 8th to the 12th we had the most wintry weather of the whole season, the roads being blocked up with snow drifts ; there was a thaw on the 12th and 13th, so that the plains were freed from snow. Aurora on 7th and 18th. Gales of 50 miles an hour on 18th and 28th, and one of 40 miles an hour on 31st, from 9 p.m. till 1 a.m. on the following morning.

IRELAND.

DARRYNANE.—First week fine but foggy, with variable wind. Snow on night of 8th, 9th, and showers of snow all day on 9th ; frost on 10th and 11th, thence to 24th, moderate to fresh. W. and N. Westerly winds ; last week constant gales from S. to W. and heavy sea. Heavy rain on morning of 29th, and great floods.

MONKSTOWN.—A very dry month, with the exception of the last week, which was very wild, strong westerly winds prevailing ; severe frost on the nights of the 9th and 10th.

GALWAY.—Aurora on night of 7th.

BALLYSHANNON.—The month on the whole has been a severe one, and remarkable for its sudden changes of temp. The frost did not continue long enough for ice of sufficient strength to be stored for the preservation of salmon, but instead a large quantity of snow has been accumulated, which, when kept from the air, is found a good substitute for ice. Aurora visible from 9.45 to 10 p.m. on 7th. S on 9th, 10th, and 11th ; all disappearing next day. Gale from S.W. on 19th. Storm from S.W. with T L on 29th, wind continuing to the end of the month.

WARINGSTOWN.—There were S showers on seven days this month ; but, generally speaking, it was mild.

EDENFELL, OMAGH.—Weather of the month notable for its sudden vicissitudes, remarkably fine and mild from 1st to 8th, 12th to 18th, and 22nd to 27th ; the remaining periods, viz., from 8th to 12th, 19th to 22nd, and 27th to end being equally remarkable for heavy S and keen frost, sudden and heavy gales, and R squalls respectively. Sowing of grain, &c., backward, owing to the almost entire absence of the usual spring easterly winds to dry the soil.